



## Association between triglycerides and HDL-cholesterol ratio and cardiovascular risk factors among elderly persons receiving care under the family health strategy of Viçosa, Minas Gerais

Marcos Vidal Martins<sup>1</sup>  
Jacqueline Danesio de Souza<sup>2</sup>  
Karina Oliveira Martinho<sup>3</sup>  
Fernanda Silva Franco<sup>4</sup>  
Adelson Luiz Araújo Tinôco<sup>5</sup>

### Abstract

**Objective:** To evaluate the association between triglycerides and HDL-cholesterol (TG/HDL-c) ratio and cardiovascular risk factors among the elderly. **Method:** A cross-sectional epidemiological study with a random sample of elderly persons (n=349) of both genders, who received care under the Family Health Strategy in the municipality of Viçosa, in the state of Minas Gerais, was performed. Cardiovascular risk was calculated by the relationship between the TG and the HDL-c levels, with values greater than 3.5 considered a risk. Social and economic variables, lifestyle, noncommunicable chronic diseases, serum glucose levels, waist circumference (WC) and body mass index were evaluated. Multiple linear regression was used to evaluate the association between the TG/HDL-c ratio and other variables. Variables associated with the dependent variable with a level of significance lower than 0.20 in univariate regression analysis were included in the final model (stepwise-forward), applying a significance level of  $p < 0.05$ . **Results:** The highest TG/HDL-c ratio values were associated with the presence of hypertension, having been or currently be a smoker, having elevated serum glucose and an increased waist circumference. **Conclusion:** The findings reflect the importance of studies on cardiovascular risk in the elderly, as health professionals should be familiar with the parameters that classify at risk individuals. The TG/HDL-c ratio is a reliable classification method that is easy to apply and correlates closely with adverse health effects.

**Keywords:** Cardiovascular Risk. Chronic Disease. Health of the Elderly.

<sup>1</sup> Universidade Federal do Oeste da Bahia (UFOP), Centro de Ciências Biológicas e da Saúde, Departamento de Nutrição. Barreiras, Bahia, Brasil.

<sup>2</sup> Universidade Federal de Goiás (UFG), Departamento de pós-graduação em Ciências da Saúde, Faculdade de Medicina. Goiânia, Goiás, Brasil.

<sup>3</sup> Faculdade de Ciências e Tecnologia de Viçosa (FACISA/UNIVIÇOSA), Departamento de Fisioterapia. Viçosa, Minas Gerais, Brasil.

<sup>4</sup> Faculdade Atenas, Unidade Paracatu, Departamento de Nutrição. Paracatu, Minas Gerais, Brasil.

<sup>5</sup> Universidade Federal de Viçosa (UFV), Departamento de Nutrição. Viçosa, Minas Gerais, Brasil.

## INTRODUCTION

The Brazilian age pyramid has seen an increase in the country's elderly population, with a concomitant increase in chronic noncommunicable diseases (CNCD). Among these, diseases of the cardiovascular system are responsible for the major causes of mortality, mainly among the elderly<sup>1,2</sup>.

Since the 1960s, cardiovascular diseases have been the leading cause of death in Brazil and have been responsible for a significant impact on the mortality and morbidity of individuals of all age groups, but especially among the elderly<sup>3,4</sup>. While few studies analyze the health situation of the Brazilian elderly community, it is extremely important to evaluate cardiovascular risk factors and monitor the health situation of patients. The investigation of the factors associated with cardiovascular risk is fundamental for the actions of the various actors involved, contributing, therefore, to better strategies to protect and promote the health of the elderly.

The ratio between triglycerides and HDL-cholesterol (TG/HDL-c) is used as an indicator of dyslipidemia due to its relationship with increases in cardiovascular risk. It is also considered an easy and rapid indicator to obtain, especially in the context of primary health care. Recent analyzes have shown that this ratio is a potent predictor of the development of coronary heart disease and is directly correlated with plasma B-type LDL-cholesterol levels<sup>5-8</sup>. As such, the objective of the present study was to evaluate the association between the TG/HDL-c ratio and cardiovascular risk factors among elderly persons receiving care under the Estratégia Saúde da Família (Family Health Strategy) (ESF) in the municipal district of Viçosa, Minas Gerais, Brazil.

## METHOD

A cross-sectional epidemiological study with a probabilistic sample of elderly people (aged 60 years of age or older), of both genders, attending all 15 ESF units in the city of Viçosa, Minas Gerais, was performed. Elderly people living in Viçosa who attended the ESF from August 2011 to June 2012 were included. Those with special needs were

excluded as well as those who for some reason did not undergo the biochemical examination.

The total estimated population of Viçosa<sup>9</sup> was 72,244 individuals, of whom 10,692 (14,8%) were aged over 60 years. The number of elderly users (6,298) of the ESF was used to calculate the sample size, considering a 95% confidence level, a prevalence of metabolic syndrome of 65% and a tolerated error of 5%. Thus, the sample was 331 elderly persons, to which was added 20% to cover possible losses, totaling 398 elderly persons to be studied. However, elderly persons with consultations already scheduled were also included, giving a final sample of 402 elderly persons.

Regular attendees of the ESF were randomly selected and contacted by health workers to attend a meeting at the ESF that served the area where they lived, at which they received information about the importance and objectives of the project and assurances about the confidentiality of data. Those elderly people who agreed to participate signed a Free and Informed Consent Form (FICF) and data collection began.

Data collection took place through the visits of the research team, which consisted of a nurse, physiotherapist, physical education professional and nutritionists, to the ESF units. A structured, standardized and pre-tested questionnaire was applied in a pilot study. The independent variables evaluated at the first meeting were: socioeconomic and demographic (age, gender, marital status, years of schooling and economic class); lifestyle (smoker, alcohol consumption and sedentary behavior) and presence of morbidities (heart disease, dyslipidemia, hypertension, diabetes, presence of depressive symptoms). Next, the anthropometric data for obesity classification (weight, height and waist circumference) were measured. At the second meeting a biochemical evaluation was performed with participants fasting for 12 hours, with serum glucose, TG and HDL-c levels analyzed.

Cardiovascular risk was calculated by the relationship between TG and HDL-c levels, with a value greater than 3.57 being considered at risk. To evaluate the consumption of alcoholic beverages, type of beverage consumed, frequency

and quantity consumed during the week prior to data collection was evaluated, to determine the grams of ethanol consumed by the elderly persons per day. The consumption of alcoholic beverages with an ethanol dosage of more than 30g/day for men and 15g/day for women was considered as a cardiovascular risk factor<sup>10,11</sup>.

Economic class was evaluated in accordance with the Critério de Classificação Econômica da Associação Brasileira de Empresas de Pesquisa (the Economic Classification Criteria of the Brazilian Association of Research Companies) (ABEP)<sup>12</sup>. The Geriatric Depression Scale (GDS) was used to evaluate the presence of depressive symptoms<sup>13</sup>. Individuals who scored less than or equal to 5 points were considered without depressive symptoms while elderly persons who scored more than 5 points were considered to have depressive symptoms.

The anthropometric measures were performed according to the procedures recommended by Lohman et al.<sup>14</sup>, following standardization. Weight was measured in kilograms, using a portable digital electronic scale (Tanita), properly calibrated, with a capacity of up to 150kg and a precision of 100g. Height was measured using a two-meter ruler with a precision of 0.1cm fixed to a smooth wall without skirting board, with the aid of a plumb line and wooden set square. Weight and height were measured in duplicate, with the arithmetic mean of the measurements taken as the result. Body mass index (BMI) was defined according to the criterion proposed by Lipschitz<sup>15</sup>. Waist circumference (WC) was obtained using a non-extensible measuring tape, placed immediately above the umbilical scar, with a reading taken at the time of expiration, using the cut-off point recommended by the World Health Organization<sup>16</sup>: <94 cm (normal), between 94 and 102cm (increased) and  $\geq 102$ cm (substantially increased) for men and <80cm (normal), between 80 and 88cm (increased) and  $\geq 88$ cm (substantially increased) for women.

To evaluate the presence of sedentary behavior, the International Physical Activity Questionnaire (IPAQ)<sup>17</sup> was used. Sedentary behavior was characterized by remaining sitting or lying down, including during transport, for more than two hours a day<sup>18</sup>.

The descriptive analysis of the variables was presented by mean/median and standard deviation. The normality of the distribution of the variables was evaluated by the Shapiro-Wilk test. Data on the dependent variable were log-transformed for normal distribution. Associations with the categorical variables were performed using the Chi-squared test. For the continuous variables, the Student's t-test was used. The level of significance was 5%.

The association between cardiovascular risk and the independent variables was performed by multiple linear regression analysis. Only variables that were associated with the dependent variable with a significance level lower than 0.20 in univariate regression analysis were included in the final model. The final model was performed through stepwise-forward regression, where the variables were entered one by one in the final equation. The significance level adopted was 5%.

The study complied in its entirety with the guidelines for research involving human beings, Resolution 466/2012 of the National Health Council. The research project received the prior approval of the Human Research Ethics Committee of the Universidade Federal de Viçosa (Viçosa Federal University) (n° 04/2013).

## RESULTS

Data from 349 elderly people were analyzed. The mean age of the sample was between 70 and 79 years (47.2%), and the subjects were married (68.1%), belonged to social classes CDE (84.6%), had at least one year of schooling (76.9%) and were mostly male (47.2%) (Table 1).

The characteristics related to life habits and health conditions are described in Table 2. The majority of individuals at cardiovascular risk were smokers (current and ex-smokers) (52.8%), never drink (57.1%), exhibited sedentary behavior (86.8%), did not present depressive symptoms (82.4%) and reported having dyslipidemia (53.9%) and hypertension (80.2%).

The anthropometric variables and the serum glucose levels are shown in Table 3. It was

observed that the majority of the elderly persons at cardiovascular risk had increased mean BMI, WC and serum glucose levels.

In univariate linear regression analysis, the variables that obtained a *p* value below 0.2 were age, marital status, economic class, schooling,

heart disease, dyslipidemia, obesity, hypertension, diabetes, smoking, depressive symptoms, serum glucose levels, WC and BMI. The variables that remained statistically significant in the final multiple linear regression model are presented in Table 4. The variables arterial hypertension, smoking, serum glucose levels and WC were retained.

**Table 1.** Distribution of the elderly classified as with or without cardiovascular risk by the TG/HDL-c ratio, according to sociodemographic variables. Viçosa, Minas Gerais, 2011 a 2012.

Variable	Without cardiovascular risk (n=258) n (%)	With cardiovascular risk (n=91) n (%)	<i>p</i>
Gender			
Male	98 (38)	47 (51.6)	0.02 *
Female	160 (62)	44 (48.4)	
Age range (years)			
60-69	100 (38.8)	40 (44)	0.13 **
70-79	113 (43.8)	43 (47.2)	
80 or more	45 (17.4)	8 (8.8)	
Situação conjugal			
Casado	144 (55.8)	62 (68.1)	0.04 *
Sozinho	114 (44.2)	29 (31.9)	
Socioeconomic class			
AB	23 (8.9)	14 (15.4)	0.08 *
CDE	235 (91.1)	77 (84.6)	
Schooling			
Illiterate	73 (28.3)	21 (23.1)	0.33 *
≥ 1 year	185 (71.7)	70 (76.9)	

\**p*-value in chi-squared test; \*\**p*-value in chi-squared test for linear trend.

**Table 2.** Distribution of elderly persons classified as with or without cardiovascular risk based on TG/HDL-c ratio, in accordance with lifestyle and health conditions. Viçosa, Minas Gerais, 2011 to 2012.

Variable	Without cardiovascular risk (n=258) n (%)	With cardiovascular risk (n=91) n (%)	<i>p</i> *
Smoking			
No	157 (60.8)	43 (47.2)	0.02
Yes	101 (39.2)	48 (52.8)	
Alcohol consumption			
No	160 (62)	52 (57.1)	0.41
Yes	98 (38)	39 (42.9)	

to be continued

continued from Table 2

Variable	Without cardiovascular risk (n=258) n (%)	With cardiovascular risk (n=91) n (%)	<i>p</i> *
Sedentary behavior			
No	24 (9.3)	12 (13.2)	0.29
Yes	234 (90.7)	79 (86.8)	
Depressive symptoms			
No	188 (73.1)	75 (82.4)	0.07
Yes	69 (26.9)	16 (17.6)	
Cardiopathy			
No	228 (88.4)	75 (82.4)	0.14
Yes	30 (11.6)	16 (17.6)	
Dyslipidemia			
No	146 (56.6)	42 (46.1)	0.08
Yes	112 (43.4)	49 (53.9)	
Obesity			
No	230 (89.1)	67 (73.6)	0.001
Yes	28 (10.9)	24 (26.4)	
Arterial hypertension			
No	80 (31)	18 (19.8)	0.04
Yes	178 (69)	73 (80.2)	
Diabetes			
No	195 (75.6)	53 (58.2)	0.002
Yes	63 (24.4)	38 (41.8)	

\**p*-value in chi-squared test.**Table 3.** Comparison of body mass index, waist circumference and serum glucose level means of elderly persons with or without cardiovascular risk based on TG/HDL-c. Viçosa, Minas Gerais, 2011 to 2012.

Variable	Without cardiovascular risk (n=258) Mean (sd)	With cardiovascular risk (n=91) Mean (sd)	<i>p</i> *
Body mass index	25.9 (±4.5)	28.3 (±4.1)	<0.001
Waist circumference	92.0 (±11.3)	98.9 (±10.2)	< 0.001
Glucose	110.9 (±28)	124.8 (±41.6)	< 0.001

\* *p*-value in Student's t-test; sd: standard deviation.**Table 4.** Final result of multiple linear regression model, adjusted for age. Viçosa, Minas Gerais, 2011 to 2012.

Variable	$\beta_{\text{adjusted}}$	CI95%	<i>p</i>
Arterial hypertension	0.16	0.02 - 0.31	0.02
Smoking	0.15	0.02 - 0.27	0.02
Glucose	0.003	0.001 - 0.005	<0.001
Waist circumference	0.001	0.009 - 0.022	<0.001

\* *p*-value in Multiple Linear Regression model; CI: confidence interval.

## DISCUSSION

Through the results, it was possible to identify cardiovascular risk from the TG/HDL-c ratio of the elderly population receiving care under the FHS of the city of Viçosa, Minas Gerais, and the associated risk factors. Because of the cross-sectional design of the study, it is possible to reflect on the situation of this population at the time of the evaluation.

Although no studies were found that evaluated cardiovascular risk and protective factors among elderly persons based on TG/HDL-c, the results identified corroborate with other studies that evaluate associations between heart disease and the same variables as the present study.

A study verified factors associated with the prevention of cardiovascular diseases among hypertensive elderly persons, emphasizing that socioeconomic factors, health characteristics and use of health services influence the practice of healthy eating habits for the prevention of cardiovascular disease<sup>19</sup>. Poor eating habits contribute to the development of different diseases related to cardiovascular complications, and the presence of two risk factors (hypertension and excess body fat) directly related to diet was associated with reduced functional capacity among the elderly<sup>20,21</sup>. The importance of diet in the prevention of cardiovascular events in the elderly population is highlighted, with a high consumption of fats and sugars and a low consumption of healthy fruits and vegetables noted among this group<sup>22</sup>.

In a study by Ferreira et al. of elderly patients receiving care in the SUS (Unified Health Service) in the city of Goiânia in the state of Goiás, the risk factors obesity, central obesity, sedentary lifestyle and alcohol consumption were associated with the risk of heart disease<sup>3</sup>. The present study is similar to those mentioned above, as the variables associated with cardiovascular risk in our study were hypertension, smoking, increased glycaemia and elevated blood pressure.

Smoking is an important risk factor for cardiovascular diseases<sup>23,24</sup>. It is estimated that this habit is the leading cause of preventable death in the world, doubling the risk of coronary artery disease<sup>25,26</sup>.

In a study conducted with 3,142 elderly people from 16 Brazilian state capitals, it was observed that the prevalence of smokers significantly declined with aging, while the proportion of ex-smokers increased. The factor of smoking (ex-smoker) was one of the risk factors for ischemic heart disease, corroborating with the findings of the present study<sup>19</sup>.

Alterations in fasting glycaemia in subjects with cardiovascular risk were found, in agreement with other studies of the elderly<sup>27,28</sup>. In a review of literature it was observed that diabetic individuals had a three to four times greater risk of suffering a cardiovascular event and twice the risk of dying from this event than the general population<sup>29</sup>.

Insufficient physical exercise influences the development of dyslipidemia and atherosclerosis<sup>30</sup>. Studies have shown that physically active adults have a higher plasma concentration of HDL-c and lower concentrations of LDL-c and TG than sedentary individuals<sup>31,32</sup>. Increased glucose and WC levels may be due to the absence of physical exercise, contributing to a poor prognosis in individuals with cardiovascular risk<sup>33</sup>.

The innovative use of the TG/HDL-c ratio as an indicator of cardiovascular risk in the elderly, and the increased understanding of the problem achieved through the association with different risk factors present in the studied population, are notable features of the present study. However, a design which does not allow observation of the follow-up period of the individuals, or the establishing of causal relations between the analyzed variables, are limitations. It should be noted that while many studies consider schooling to be a risk factor for cardiovascular diseases, no significant differences were established in the present study, possibly due to the stratification criteria used. In addition, the comparison with other scientific studies was hampered by the scarcity of works that consider the cardiovascular risk classification addressed.

## CONCLUSION

Cardiovascular risk based on TG/HDL-c ratio was associated with hypertensive elderly persons, smokers, and those with high glycaemia and central

obesity. Understanding the magnitude of the various risk factors for cardiopathies among the elderly is essential for the preparation of effective preventive plans, and health professionals should be familiar with the parameters that classify individuals with cardiovascular risk. The TG/HDL-c ratio is an easy, non-invasive and reliable method that assists in the promotion and prevention of the health of the elderly.

In view of the findings, it is recommended that the TG/HDL-c ratio is used in clinical practice and to perform longitudinal studies on cardiovascular risk among the elderly, in view of the high and growing cost of treating heart disease. It is also important to emphasize the importance of the development of nutrition and health education strategies, in order to combat the potential cardiovascular risk factors found.

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